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U.S. DEPARTMENT OF THE NAVY
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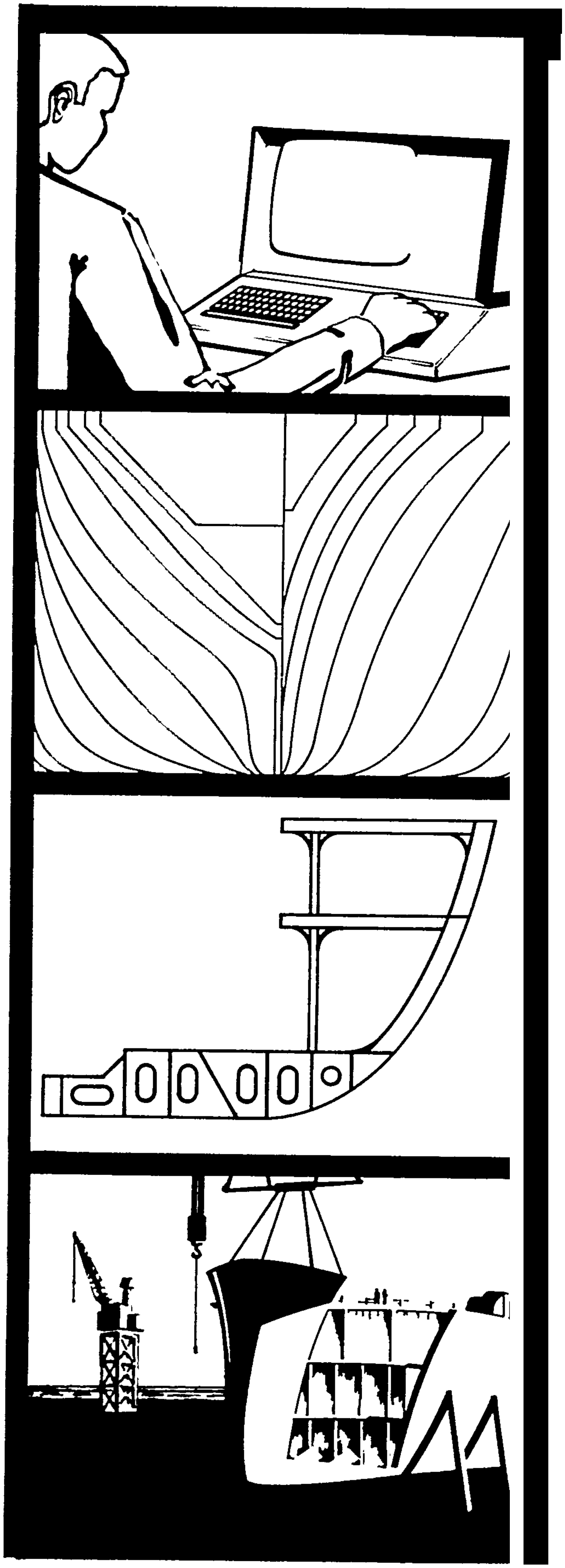

R ESEARCH
AND
E NGINEERING
FOR
A UTOMATION
AND
P RODUCTIVITY
IN
S HIPBUILDING

Proceedings of the REAPS Technical Symposium

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DISCLAIMER

A USER'S VIEW OF THE SPADES HULLOAD PROGRAM FOR SPECIFYING SHIP STRUCTURE

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As Engineering Hull Section Manager, Mr. Mayer is currently responsible for all engineering hull structural drawing development, N/C hulload coding, N/C development within shipyard and welding and hull structural standards development. He has 18 years experience in shipbuilding engineering spanning three shipbuilding concerns (Todd-Houston, Gulfport and Livingston) as drafting designer in all shipbuilding disciplines, drafting supervisor, assistant chief hull engineer and hull section manager.

INTRODUCTION

Livingston Shipbuilding is a medium to small shipbuilding complex that builds both conventional marine vessels and offshore drilling equipment. We have been involved with Numerical Control Lofting for over three (3) years and have built three (3) jack-up drilling rigs, two (2) drill ships, a Great Lakes products carrier and processed several industrial products, contracts with the N/C controlled burning machine.

The Engineering Hull Section is responsible for the loading of the data base with SPADES HULLAD program. This program defines the locations of decks, sight edges, longitudinal bulkheads and all structures that Comprise a marine vessel. This program is easy to implement and the Hull Section draftsmen are used as programmers for establishing this important part of the ship's data base.

HULLOAD MODULE

About three years ago I was called into the front office and told that I was chosen to participate in a new program called Numerical Controlled Lofting. Having been in shipyards for several years I knew what lofting was, but I had no previous knowledge of numerical control and being from engineering, what function I would have in relation to lofting. When told that the ultimate goal of N\C lofting was to automatically mark and cut ship parts out of steel, I was both amazed and curious. The next thing to do was to learn what this new system consisted of and exactly the role engineering would have.

N\C lofting is divided into four main parts; fairing the lines, defining the structural locations, generating the ship parts and nesting

hose parts on plates for marking and burning. The lines drawings are usually a function of the Engineering Design Section with input from the Hull Section concerning cant frame locations and additional frames for erection butts if required. The Hull Section with drawings sets the locations of hull structural item and it is only natural that the Engineering Hull Section be responsible for implementation of the N/C program that defines hull structures. Since the N/C system that Livingston chose was the SPADES (Ship Production and Design Engineering Systems) system, the particular name for the program that defines structural locations is called the HULLOAD program. Management felt that the N\C HULLOAD program should remain an Engineering Hull Section function rather than a loft function, as is the case in many other shipbuilding facilities.

The next problem to solve was how to implement this new system and who to choose for training in HULLOAD coding. We felt that our experienced draftsmen would be the best choice, since loading of hull structure into a data base is similar to defining structure locations on engineering drawings. The process of teaching our present staff of draftsmen would be easier than increasing our overhead specifically for computer oriented people who knew nothing about hull structures. The choice proved to be correct since the engineering people sent for training learned enough about HULLOAD coding in two weeks to become proficient enough for normal loading.

Of course, not everyone exposed to N\C coding can become proficient; however, out of the twenty plus people trained in our facility, only five percent are completely inapt with another fifteen percent limited

in their ability to fully code- SPADESN HULLOAD. This, of course, is not to say that our training procedure is that efficient, as it is actually a testament to the ease of the SPADES HULLOAD coding system.

The HULLOAD coding system developed by Cali and Associates is based on shipbuilding terms, or retire specifically abbreviations of shipbuilding terms. Such terms as DECK, CUTS, MANU and LINE are examples of the many such commands used for commands. Ah Engineering Hull Section draftsman has no trouble understanding the code words used with this system as for example, the code for longitudinal bulkhead is "LBHD".

The codewords of this system are not the only part of HULLOAD coding that is easy for the coder to understand. The center of the program is the coordinate system which is built around the same system the manual system uses. Heights, halfbreadths and longitudinal center of gravity as represented by the X, Y, and Z axis-are as common to shipbuilding as is port and starboard. As for *port,* that *is the* side that the structure is normally loaded to; but, as ships and marine equipment are not always symmetrical., the option to load differences between port and starboard exist and is easy to do.

In the SPADES SYSTEM of coding, there are four cards or coding lines that precede each program. These are the *JOB, INPS(input start), OPTN (options), and RMKS (remarks) commands. These commands set the conditions of loading such as the tape number, measurement system, load or no load and remain the same for each tape number loaded into the Data Base.

With this program. the easiest structrual items to load are the decks and longitudinal bulkheads. A flat deck and straight longitudinal bulkhead can be loaded with **only** a one card description each. Decks with shear and more commonly camber take a minimum of five cards with loading for shear taking the most because of the offsets required. Longitudinal bulkheads may be loaded in almost any configuration including different off centerline dimensions and sloped hopper type commonly used in cargo holds.

Defining shell, longitudinal bulkhead and deck traces are also easy to load; but due to the number of traces usually required on a marine vessel, it is time consuming. A seam or stiffener trace usually requires only three lines or cards for straight line loading and with new commands REFR (reference) and RLTV (relative) even less cards are required. The new commands load each trace parallel to a previous trace by the given increments. Also, for adjustments to traces after loading is complete, a single trace can be moved without disturbing other traces with the new * SLT (select) command. This command will also work for changing decks and longitudinal bulkheads.

Probably the most difficult to load and teach how to load is the cutout definition for stiffener notches. The reason for this difficulty is the number of different cutouts usually required for ships and the description consists of manual line and circle commands which require about seven cards each. The orientation of cutout loading is also a problem due to the numerous ways stiffeners can be positioned on a ship. Loading the stiffener size itself is done with the MEMB (member) and type commands. This series of commands loads the structural members and the type of notch required to its respective trace.

The SPADES HULLOAD program is priobably the best of such programs, but there are still some problems. For instance , there is a difficulty in loading sight edges to the extreme ends of a fine lined ship, but this can be implemented with manual manipulations of the input points. Another item that is causing some difficulty is the loading of additional frames or transverse lines in between frame spaces for such things as master erection butts. However, this too can be implemented by loading additional frames with the Lines Fairing Program. So, the only real problem that the program has left the user shipyard with is the inability offloading transverse bulkheads. Even this may soon become a possibility for SPADES Users.

NEW FEATURES IN HULLOAD

Due to be released are several new features for ease of HULLOAD coding, such as the use of a “RANGE” command for the laborious. coding of member type structural definition commands. The ability to override with the use of “Exclude" and “Include” features will be used in conjunction with commands like “RANGE” for dissimilarities in structure locations. New commands for HULLOAD that are now used in parts generation module are the "LOO", ’’REP” (repetition), SUB* (sub-input data set), “JUMP”, and logical “IF" commands all of which should ease the amount of coding required for each new,contract.

Another item that should help ease the amount of HULLOAD coding will be the ability to load a surface (deck or longitudinal bulkhead) relative to an existing trace or another surface. Also to be included in the next release will be the mathematical definition of flat surfaces such as deck

and bulkheads with straight sheer and/or camber, will be **stored on the** data base as part of the future surface control records.

THE FUTURE PROSPECTS FOR HULLOAD

The future of the HULLOAD module is very bright and will be the trend setter for all such programs. The SPADES HULLOAD module will shortly have the capacity of storing on the data base complete surface definitions for all decks, longitudinal and transverse bulkheads. Also **to** be stored on the data base for each defined surface are the traces of all intersecting surfaces including the shell and defined in the plan of the surface if flat or in the appropriate view plan, elevation, or transverse). To be stored for each appropriate surface will be the traces of all defined stiffeners (longitudinal, transverse, horizontal and vertical) seams and butts in the plan of the surface if flat or in the appropriate view (plan, elevation, or transverse).

In association with surfaces and traces on surfaces the structural shapes, details and associated cut-outs will be stored on the data base for each defined stiffener on each appropriate surface. The ranges of the definitions will be included so that at any location along the sur**face** stiffener, the stiffener type, size, detail and associated cut-out can be obtained from the data base. Plate thicknesses and associated clearance cuts will be stored for each defined seam and butts on each appropriate surface similar to as described above for stiffeners.

The loading of the data base for all crossing, intersecting or secondary surfaces or frames can be. preformed almost automatically with a minimum amount of input data given by utilizing all of the above

surface and detail data. This will also improve the cross-reference and integrity of the data base.

Before, with the lines fairing and the HULLOAD modules, a ship or marine vessel was a series of interconnecting lines composed of frames, decks, sight edges, waterlines, buttocks, etc., similar to a three dimensional wire line diagram. When the future plans for the HULLOAD module become reality, we not only have a wire type diagram, but also have the planes in between so that the computer ship now represents more fully the true ship shape and configuration.

We can only visualize the true meaning this has for the shipbuilding industry and the impact on engineering and lofting manhours. The updated SPADES HULLOAD program, in conjunction with a new SPADES module called "DEMO", will be able to produce engineering drawings that require only hand finishing for dimensions and notes. The future of Numerical Control Lofting, or should I say Numerical Control Engineering and Lofting, becomes very bright indeed.

ACKNOWLEDGMENTS

Jan Ulsteen of Cali and Associates for his contributions in regard to the new features and the future of the SPADES HULLOAD program.

APPENDIX

EXAMPLES OF SPADES' HULLOAD CODING

I. SPADES Coordinate System

II. Program Start Cards for Each HULLOAD Tape Number

III. Deck Coding Eamples

A. Typical Example Coding Sheet

B. Diagram of Example Coded Decks

C. Typical Ship's File Report for Loaded Deck

IV. Longitudinal Bulkhead Coding Examples

A. Typical Example Coding Sheet

B. Diagram of Example Coded Longitudinal Bulkhead

C. Typical Ship's File Report for Loaded Longitudinal Bulkhead

V. Trace and Member Description Coding Examples

A. Shell Seam Example Coding

B. Example cf HULLOAD Coding Print-out for Shell Stiffeners

C. Example of Print-out with Error in Key Punching or Coding

D. Example of Structure Loadinq Coding

E. Ship's File Report for Shell Traces and Cut-out Numbers

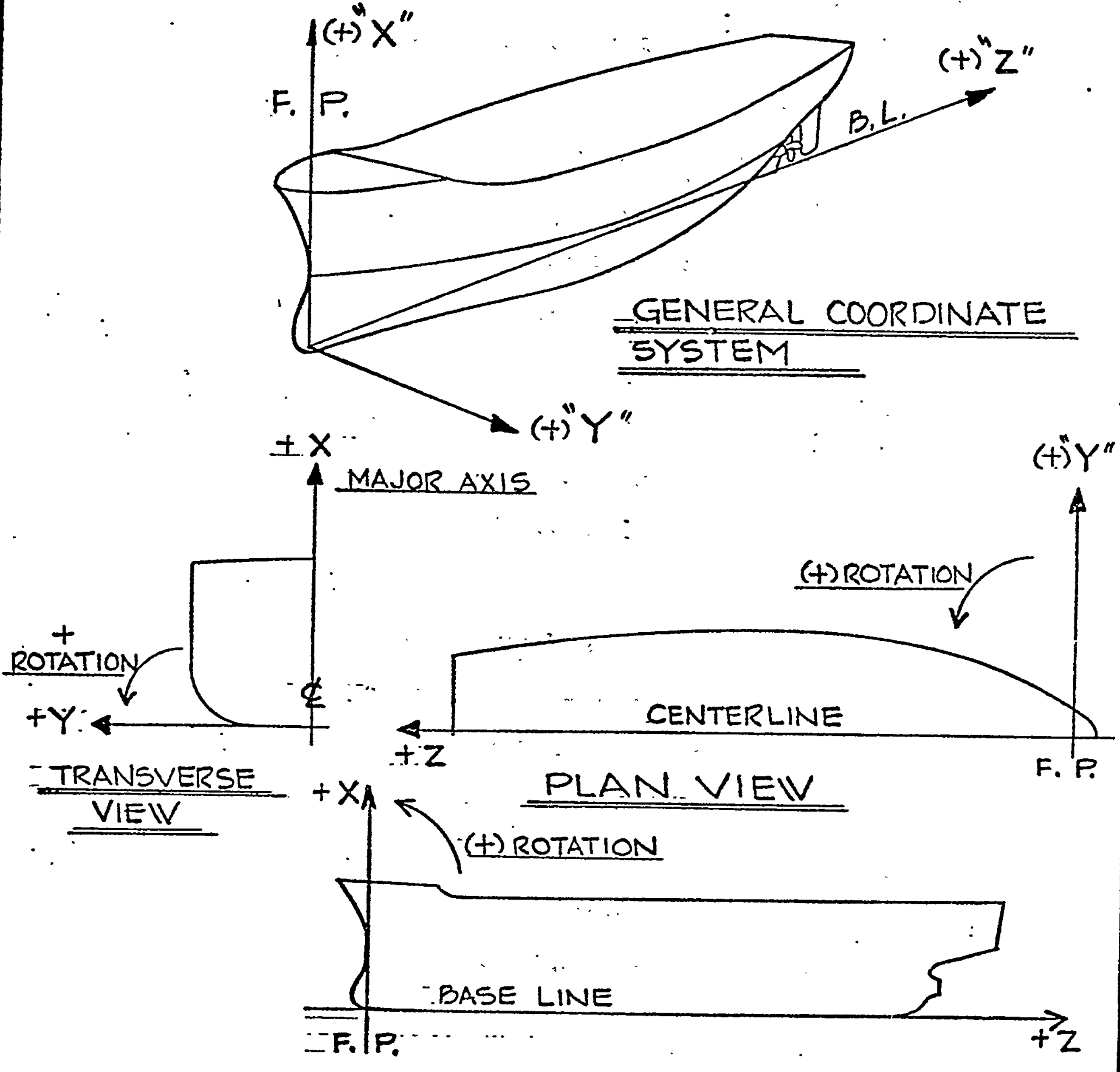
VI. Cut-out Coding Examples

A. Cut-out Coding Sheet Example

B. Diagram of Example Cut-out Coding

VII. HULLOAD Body Plan Example

REFERENCE AXIS AND VIEWS
HULLOAD PROGRAM



I.

SPADES SYSTEM INPUT DATA FORM

PROGRAM TYPICAL JOB CODING FOR EACH HULLOAD TAPE START PROGRAMMER ______ DATE ______ PAGE ___ OF ___

COMMAND	ALPHABETIC INFORMATION: CODE	2	3	4	FIELD 1 UNIT FRAC. / NAME	FIELD 2 UNIT FRAC / NAME	FIELD 3 UNIT FRAC / NAME	FIELD 4 UNIT FRAC / NAME	POINT FIELDS 1 2 3	CARD ID: JOB NO	TAPE NO	SHEET NO	LINE NO
*JØB	LS03	HULD	CISK		N 0001					17	0001	01	
INPS					N 0001								
ØPTN	16TH	LØAD	PRNT										

TAPE NO

TYPE OF INPUT (MAY NOT BE REQ'D IN LATEST RELEASE)

HULL CODE

PROGRAM CODE

JOB START COMMAND

LEVINGSTON JOB NO.

TAPE NO.

HULLOAD PROGRAM NO. (ALWAYS 17)

INPUT START COMMAND

OPTIONS FOR MEASUREMENT LOADING, PRINTING & ETC.

OPTION COMMAND

THESE COMMANDS APPEAR ON EACH HULLOAD TAPE NO.

359

II.

SPADES SYSTEM INPUT DATA FORM

PROGRAM HULLOAD DECK CODING PROGRAMMER ______ DATE ______ PAGE ___ OF ___

COMMAND	ALPHABETIC INFORMATION (CODE 2 3 4)	FIELD 1	FIELD 2	FIELD 3	FIELD 4	POINT FIELDS (1 2 3)	CARD ID (JOB NO, TAPE NO., SHEET NO)	LINE NO
*JØB	SHIPHULDDISK	N 0002					17000201	00
INPS	16TH	N 0002						04
ØPIN	DRAWLØADPRNT	V 24						08
RMKS	SHIP DECK							12
	LØADING							16
SURF								20
DECK	MAIN DECK	DMDK		Z F -3	Z F169			24
ELEV		30	Z F -3					28
		30	Z F169					32
TRSV		0	0					36
		0	9 6		K			40
		-15	36					44
DECK2	19 FT FLAT	D19F	X 19	Z F 10	Z F 80			48
INPE							17000299	99
								56
								60
								64
								68
								72
								76
								80
								84
								88
								92

TYPICAL INPUT START INFO

COMMAND FOR DECK W/CAMBER & SHEER

LONG'L DESCRIPTION (FOR SHEER)

CAMBER DESCRIPTION

KNUCKLE POINT

COMMAND FOR FLAT DECK

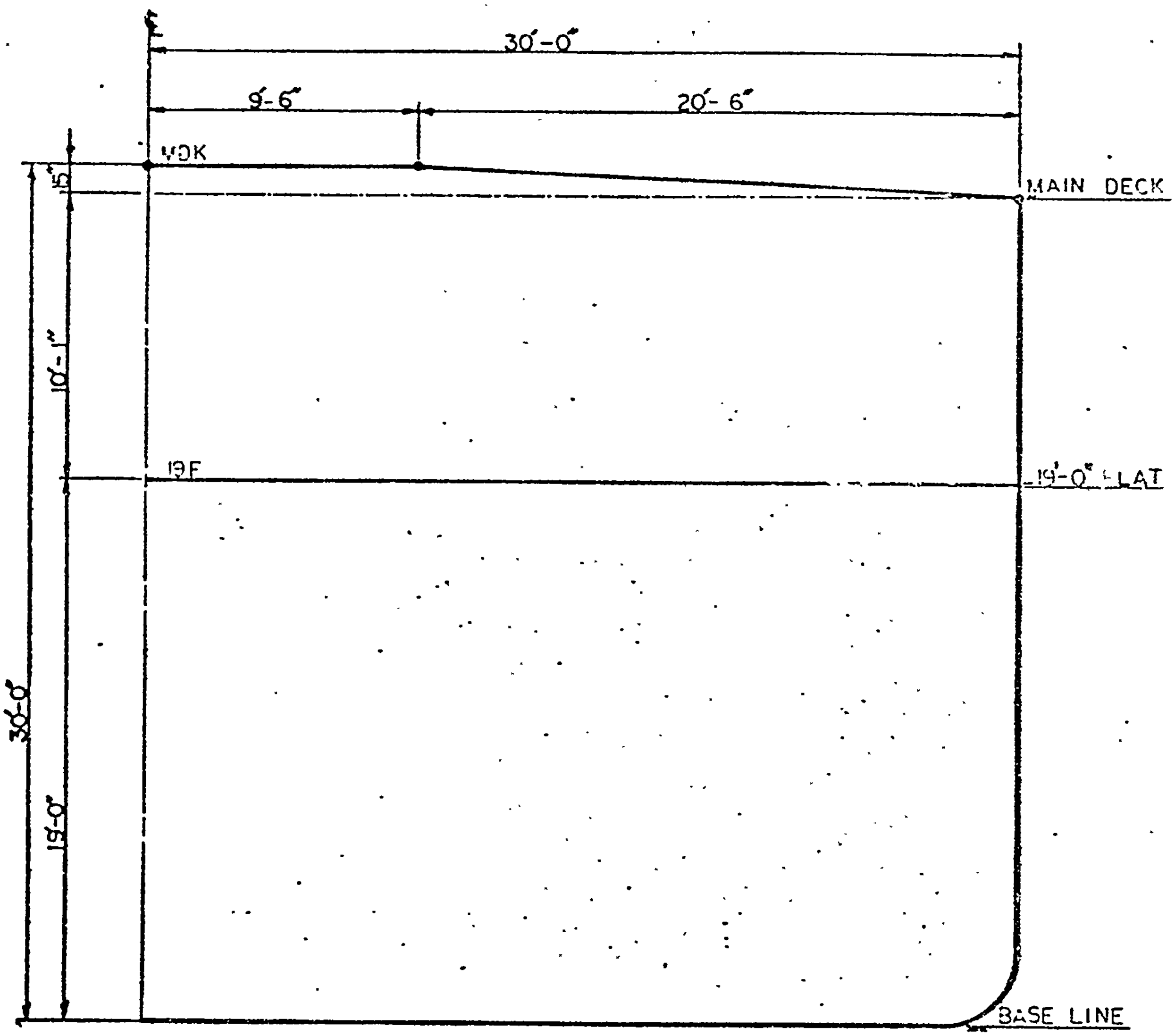
LONG'L RANGE

FEET

INCHES

16THS

III. A.



DECK LOADING EXAMPLE

III. B.

--- DECK TABLE ---

FRAME = 80000 LCG = 195.000 FRAME = 80000

RECORD LOADED 11/05/76 04/06/06 REV. 16

DECK TT		X	Y	ANGLE(DEGR)	SEG.AT SHELL
	STRT.PT.	3.000	0.0	90.000	
	END PT.	4.000	28.583	87.825	0

--- DECK CONTOUR ---

	INCREMENTAL COORDINATES					ABSOLUTE COORDINATES	
	X	Y	XC	YC	DIR	X	Y
1	0.0	2.250	-3.000	0.0		3.000	0.0
2	1.000	26.333	-3.000	-2.250		3.000	2.250
3	0.0	0.0	0.0	0.0		4.000	28.583

TOTAL NO. OF LONGITUDINALS-SEAMS = 19

	NAME	SEG	KN	ABSOLUTE COORDINATES X	Y	DX	DY	ORIENT.	TANGENT	CUTOUT NO.	MEMB NO.
LBHD.	CVK	1	0	3.000	0.0	*******	*******	0.0	90.000	100 NT	500
LONG	1	1	0	3.000	2.000	0.0	0.0	180.000	90.000	102 NT	500
SEAM	A	2	0	3.000	2.250	0.0	0.0	177.825 N	87.825	100 NT	500
LONG	2	2	0	3.078	4.292	0.0	0.0	180.000	87.825	-102 NT	500
LONG	2 P	2	0	3.078	4.292	0.0	0.0	177.825 N	87.825	100 NT	500
LONG	2 S	2	0	3.078	4.292	0.0	0.0	177.825 N	87.825	100 NT	500
LONG	3	2	0	3.165	6.583	0.0	0.0	180.000	87.825	-102 NT	500
LONG	4	2	0	3.252	8.875	0.0	0.0	180.000	87.825	-102 NT	500
LONG	5	2	0	3.339	11.167	0.0	0.0	180.000	87.825	-102 NT	500
SEAM	B	2	0	3.373	12.076	0.0	0.0	177.825 N	87.825	100 NT	500
LONG	6	2	0	3.426	13.458	0.0	0.0	180.000	87.825	-102 NT	500
LBHD	LSK	2	0	3.513	15.750	*******	*******	0.0	87.825	100 NT	500
LONG	7	2	0	3.600	18.042	0.0	0.0	180.000	87.825	-102 NT	500
LONG	8	2	0	3.687	20.333	0.0	0.0	180.000	87.825	-102 NT	500
SEAM	C	2	0	3.715	21.070	0.0	0.0	177.825 N	87.825	100 NT	500
LONG	9	2	0	3.774	22.625	0.0	0.0	180.000	87.825	-102 NT	500
LONG	10	2	0	3.861	24.917	0.0	0.0	180.000	87.825	-102 NT	500
LONG	11	2	0	3.948	27.208	0.0	0.0	180.000	87.825	-102 NT	500
SEAM	D	2	0	3.999	28.552	0.0	0.0	177.825 N	87.825	100 NT	500

RECORD LOADED 07/29/76 17/01/00 REV. 3

DECK 12F		X	Y	ANGLE(DEGR)	SEG.AT SHELL
	STRT.PT.	12.167	28.500	90.000	
	END PT.	12.167	32.500	90.000	3

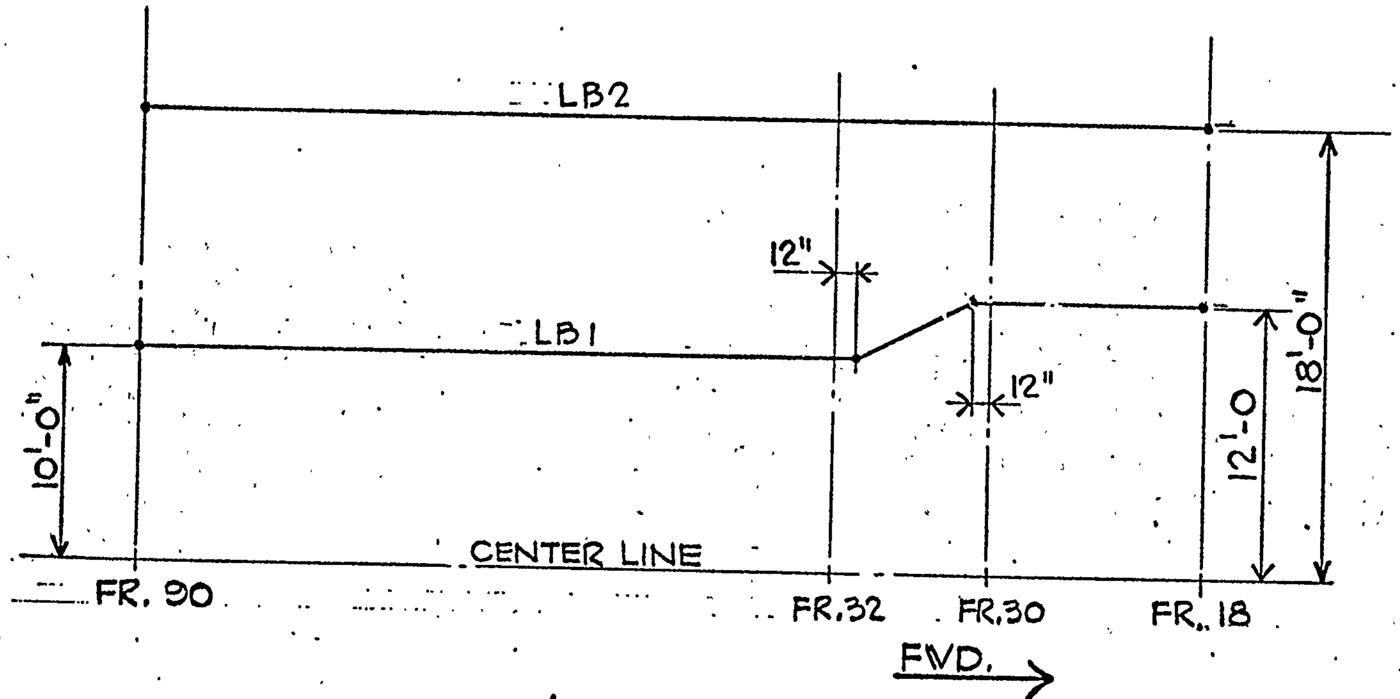
III. C.

SPADES SYSTEM INPUT DATA FORM

PROGRAM HULLOAD LONG'L BULKHEAD CODING   PROGRAMMER ______ DATE ______ PAGE ___ OF ___

COMMAND	MOD	ALPHABETIC INFORMATION (CODE, 2, 3, 4)	FIELD 1 (UNIT / FRAC / NAME)	FIELD 2 (UNIT / FRAC / NAME)	FIELD 3 (UNIT / FRAC / NAME)	FIELD 4 (UNIT / FRAC / NAME)	POINT FIELDS (1, 2, 3)	CARD ID (JOB NO, TAPE NO., SHEET NO)	LINE NO
*JØB		SHIPHULODISK	N 0C02					1700020 1	04
INPS		1 16TH	N 0C02						08
ØPTN		NDRWLØADNPRT							12
RMKS		LONG BHD							16
		LOADING							20
SURF									24
LBHD		12 TO 10 OFF BHD	LLB1		Z F 18	Z F 90			28
PLAN			12	F 18					32
			12	F 30	H1	K			36
			10	F 32	-12	K			40
			10	F 90					44
TRSY			20 .1	0					48
			5	0					52
LBHD	2	18 OFF BHD	LLB2	Y 18	Z F 18	Z F 90		1700029999	
INPE									

IV. A



LONG'L BULKHEAD LOADING EXAMPLE

IV. B.

03/06/78 09/01/30

COMPUTER OUTPUT FOR LS01 LS01[illegible]

--- TABLE OF LONGITUDINAL BULKHEADS ---

****

FRAME = 60750 LCG = 3[illegible]2.000 FRAME = 60750

RECORD LOADED 02/10/76 21/10/19 REV. 10

LBHD 218

	X	Y	ANGLE(DEGR)	SEG.AT SHELL
STRT.PT.	1.079	21.500	0.0	
END PT.	35.448	21.500	0.001	2

--- LBHD CONTOUR ---

	INCREMENTAL COORDINATES X	Y	XC	YC	DIR	ABSOLUTE COORDINATES X	Y
1	34.368	0.0	-1.079	-21.500		1.079	21.500
2	0.0	0.0	0.0	0.0		35.448	21.500

TOTAL NO. OF LONGITUDINALS-SEAMS = 21

	NAME	SEG	KN	ABSOLUTE COORDINATES X	Y	DX	DY	ORIENT.	TANGENT	CUTOUT NO.	MEMB. NO.
LONG	1	1	0	3.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
DECK	TT	1	0	5.000	21.500	*******	*******	90.0[illegible]	0.000	100 NT	500
SEAM	A	1	0	5.750	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	2	1	0	7.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	3	1	0	9.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	4	1	0	11.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	5	1	0	13.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	6	1	0	15.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
SEAM	B	1	0	15.750	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	6A	1	0	17.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	8	1	0	19.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	9	1	0	21.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	10	1	0	23.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
DECK	UTD	1	0	25.000	21.500	*******	*******	90.000	0.000	100 NT	500
SEAM	C	1	0	25.750	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	12	1	0	27.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	13	1	0	29.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	14	1	0	31.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
LONG	15	1	0	33.000	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
SEAM	D	1	0	33.750	21.500	0.0	0.0	90.000 N	0.0	100 NT	500
DECK	MDK	1	0	35.448	21.500	*******	*******	91.768	0.000	100 NT	500

RECORD LOADED 02/10/76 21/08/28 REV. 15

LBHD 338

	X	Y	ANGLE(DEGR)	SEG.AT SHELL
STRT.PT.	25.000	33.000	0.0	
END PT.	35.093	33.000	0.0	0

IV.C.

SPADES SYSTEM INPUT DATA FORM

PROGRAM: HULL LOAD TAPE #27 SHEL SEAMS AFT PROGRAMMER: [illegible] DATE: 8/25/76 PAGE 1 OF 3

COMMAND	ALPHABETIC INFORMATION	FIELD 1	FIELD 1 UNIT / NAME	FIELD 1 FRAC.		FIELD 1	FIELD 2 UNIT / NAME	FIELD 2 FRAC.	FIELD 3	FIELD 3 NAME	FIELD 4	FIELD 4 NAME	CARD ID (JOB NO / TYPE / TAPE NO. / SHEET NO)	LINE NO
KJOF	_SO3HULDDISK	N				22							1 7 0022 00	00
INPS		N				22								04
OPTN	16TH													08
RMKS	SHEL SEAMS AFT													12
TRAC														16
SHEL		L												20
SEAM	STRAKE A	J	A						[illegible]	F134	[illegible]	F179		24
PLAN			3	9			F134							28
			5	9			F179							32
SEAM	STRAKE B	J	B						[illegible]	F134	[illegible]	F179		36
PLAN			11	9			F134							40
			11	9			F179							44
SEAM	STRAKE C1	J	C1						[illegible]	F155	[illegible]	F162		48
PLAN			17	9			F155							52
			17	9			F162							56
SEAM	STRAKE C	J	C						Z	F134	Z	F156		60
PLAN			19	9			F134							64
			19	9			F156							68
SEAM	STRAKE D	J	D						[illegible]	F134	[illegible]	F179		72
PLAN			27	9			F134							76
			27	9			F137				T			80
			27	1	2		F110							84
			25	3	8		F146							88
			21	1	2		F160							92

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V.A.

```
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

INPUT UPDATING          DATE  12/28/76    TIME  19/10/51      RUN NO.   1
JOB  LS03     PROG. HULD     INPUT ID.   26       REV. NO.   2       PAGE   1

INPS                        N     0026                               1700260104
OPTN DECFLOADPRNTDRAW                                                1700260108
RMKS SHELL STIFF                                                     1700260112
     J A CAMPBELL                                                    1700260116
TRAC                                                                 1700260120
SHEL                          M                                      1700260124
LONG                          S  1                                   1700260128
PLAN                            2000    F134                         1700260132
                                2000    F140                         1700260136C
LONG                          S  2                                   1700260140
PLAN                            4292    F134                         1700260144
                                4292    F140                         1700260148C
LONG                          S  3                                   1700260152
PLAN                            6583    F134                         1700260156
                                6583    F140                         1700260160C
LONG                          S  5                                   1700260164
PLAN                           11167    F134                         1700260168
                               11167    F140                         1700260172C
LONG                          S  8                                   1700260176
PLAN                           20333    F134                         1700260180
                               20333    F140                         1700260184C
LONG                          S 10                                   1700260200
PLAN                           24917    F134                         1700260204
                               24917    F140                         1700260208C
LONG                          S 11                                   1700260216
PLAN                           27208    F134                         1700260220
                               27208    F140                         1700260224C
LONG                          S 12                                   1700260228
PLAN                           29500    F134                         1700260232
                               29500    F140                         1700260236C
INPE                                                                 1700269999
         1         2         3         4         5         6         7         8
12345678901234567890123456789012345678901234567890123456789012345678901234567890

              SEVERITY = 0    INPUT IS STORED WITH REV. =   3

                                INPUT IS EXECUTABLE
                 INPUT:   INPS                     N    0026

OPTIONS IN EFFECT :     DECF - PRNT - NDRW - LOAD - FRAM -

                 INPUT:   OPTN DECFLOADPRNTDRAW

OPTIONS IN EFFECT :     DECF - PRNT - DRAW - LOAD - FRAM -

DRAWING TAPE NO.  :  170026 -    0   SCALE  1/   0.  : ORIGIN  X0 =    0.0
                                                           Y0 =    0.0
                                                           Z0 =    0.0

                 INPUT:   RMKS SHELL STIFF
                 INPUT:       J A CAMPBELL
                 INPUT:   TRAC
```

V. B.

```
                                INPS                 N    0026                     17  26 104
 *** ERROR  503606   SEVERITY =  6   AT SEQ.          0
                                OPTN DECFLOADPRNTDRAW                              17  26 108
                                RMKS SHELL STIFF                                   17  26 112
                                      J A CAMPBELL                                 17  26 116
                                TRAC                                               17  26 120
                                SHEL                 M                             17  26 124
                                LONG                 S  1                          17  26 128
                                PLAN                     2000    F134              17  26 132
                                                         2000    F136              17  26 136
                                LONG                 S  2                          17  26 140
                                PLAN                     4292    F134              17  26 144
                                                         4292    F136              17  26 148
                                LONG                 S  3                          17  26 152
                                PLAN                     6583    F134              17  26 156
                                                         6583    F136              17  26 160
                                LONG                 S  5                          17  26 164
                                PLAN                    11167    F134              17  26 168
                                                        11167    F136              17  26 172
                                LONG                 S  8                          17  26 176
                                PLAN                    20333    F134              17  26 180
                                                        20333    F136              17  26 184
                                LONG                 S 10                          17  26 200
                                PLAN                    24917    F134              17  26 204
                                                        24917    F136              17  26 208
                                LONG                                               17  26 212
                                PLAN                 S 11                          17  26 216
                                                        27208    F134              17  26 220
                                                        27208    F136              17  26 224
                                LONG                 S 12                          17  26 228
                                PLAN                    29500    F134              17  26 232
                                                        29500    F136              17  26 236
                                INPE                                               17  269999
```

V.C.

SPADES SYSTEM INPUT DATA FORM #32

PROGRAM MEMBER & TYPE - TAPE #32 PROGRAMMER ______ DATE 11-11-76 PAGE 1 OF 1

COMMAND	ALPHABETIC INFORMATION (CODE, 2, 3, 4)	FIELD 1		FIELD 2			FIELD 3			FIELD 4			POINT FIELDS (1, 2, 3)	CARD ID: JOB NO	TAPE NO.	SHEET NO	LINE NO
			UNIT / FRAC / NAME		UNIT	FRAC / NAME			UNIT / NAME			UNIT / NAME					
*JOB	LSCSHULDCISK		0032											17	0032	00	00
INPE			0032														04
ØPTN	16THLOADPRNT																08
MEMB		M		S	1		Z	F	17	Z	F	35					12
TYPE				N		-101											16
MEMB		M		S	2		Z	F	17	Z	F	35					20
TYPE				N		101											24
MEMB		M		S	3		Z	F	17	Z	F	35					28
TYPE				N		101											32
MEMB		M		S	5		Z	F	17	Z	F	35					36
TYPE				N		101											40
MEMB		M		S	6		Z	F	17	Z	F	35					44
TYPE				N		101											48
MEMB		M		S	7		Z	F	21	Z	F	35					52
TYPE				N		101											56
MEMB		M		S	8		Z	F	23	Z	F	35					60
TYPE				N		101											64
MEMB		M		S	10		Z	F	29	Z	F	35					68
TYPE				N		101											72
MEMB		M		S	11		Z	F	35	Z	F	35					76
TYPE				N		101											80
INPE														17	0032	99	84
																	88
																	92

V.D.

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--- TABLE OF TRACES ---

****

FRAME = 82000 LCG = 200.000 FRAME = 82000

RECORD LOADED 11/23/76 00/14/27 REV. 15

TOTAL NUMBER OF SHELL TRACES = 27

	NAME	SEG	KN	ABSOLUTE COORDINATES X	Y	DX	DY	ORIENT.	TANGENT	CUTOUT NO.	MEMB. NO.
LBHD	CVK	1	0	0.0	0.0	*******	*******	0.0	90.000	100 NT	500
STRG	CL	1	0	0.0	0.0	0.0	0.0	-0.000 N	90.000	100 NT	500
STRG	1	1	0	0.0	2.000	0.0	0.0	-0.000 N	90.000	101 NT	500
SEDG	A	1	0	0.0	3.750	0.0	0.0	180.000 N	90.000	100 NT	500
STRG	2	1	0	0.0	4.292	0.0	0.0	-0.000 N	90.000	101 NT	500
STRG	3	1	0	0.0	6.583	0.0	0.0	-0.000 N	90.000	101 NT	500
STRG	4	1	0	0.0	8.875	0.0	0.0	-0.000 N	90.000	101 NT	500
STRG	5	1	0	0.0	11.167	0.0	0.0	-0.000 N	90.000	101 NT	500
SEDG	B	1	0	0.0	11.750	0.0	0.0	180.000 N	90.000	100 NT	500
STRG	6	1	0	0.0	13.458	0.0	0.0	-0.000 N	90.000	101 NT	500
LBHD	LSK	1	0	0.0	15.750	*******	*******	0.0	90.000	100 NT	500
STRG	7	1	0	0.0	18.042	0.0	0.0	-0.000 N	90.000	101 NT	500
SEDG	C	1	0	0.0	19.750	0.0	0.0	180.000 N	90.000	100 NT	500
STRG	8	1	0	0.0	20.333	0.0	0.0	-0.000 N	90.000	101 NT	500
STRG	9	1	0	0.0	22.625	0.0	0.0	-0.000 N	90.000	101 NT	500
STRG	10	1	0	0.0	[illegible]	0.0	0.0	-0.000 N	90.000	101 NT	500
STRG	11	1	0	0.0	27.208	0.0	0.0	-0.000 N	90.000	101 NT	500
SEDG	D	1	0	0.0	27.750	0.0	0.0	180.000 N	90.000	100 NT	500
STRG	12	2	0	0.0	29.500	0.0	0.0	-0.000 N	90.000	101 NT	500
SEDG	E	3	0	4.000	32.500	0.0	0.0	90.000 N	0.0	100 NT	500
SEDG	F	3	0	11.000	32.500	0.0	0.0	90.000 N	0.0	100 NT	500
DECK	12F	3	0	12.167	32.500	*******	*******	-90.000	0.0	100 NT	500
SEDG	G	3	0	18.000	32.500	0.0	0.0	90.000 N	0.0	100 NT	500
DECK	19F	3	0	19.750	32.500	*******	*******	-90.000	0.0	100 NT	500
SEDG	H	3	0	25.000	32.500	0.0	0.0	90.000 N	0.0	100 NT	500
DECK	MDK	3	0	29.000	32.500	*******	*******	-88.107	0.0	100 NT	500
SEDG	J	3	0	29.750	32.500	0.0	0.0	90.000 N	0.0	100 NT	500

****

FRAME = 83000 LCG = 202.500 FRAME = 83000

RECORD LOADED 11/23/76 00/14/28 REV. 15

TOTAL NUMBER OF SHELL TRACES = 27

	NAME	SEG	KN	ABSOLUTE COORDINATES X	Y	DX	DY	ORIENT.	TANGENT	CUTOUT NO.	MEMB. NO.
LBHD	CVK	1	0	0.0	0.0	*******	*******	0.0	90.000	100 NT	500
STRG	CL	1	0	0.0	0.0	0.0	0.0	-0.000 N	90.000	100 NT	500
STRG	1	1	0	0.0	2.000	0.0	0.0	-0.000 N	90.000	101 NT	500
SEDG	A	1	0	0.0	3.750	0.0	0.0	180.000 N	90.000	100 NT	500
STRG	2	1	0	0.0	4.292	0.0	0.0	-0.000 N	90.000	101 NT	500

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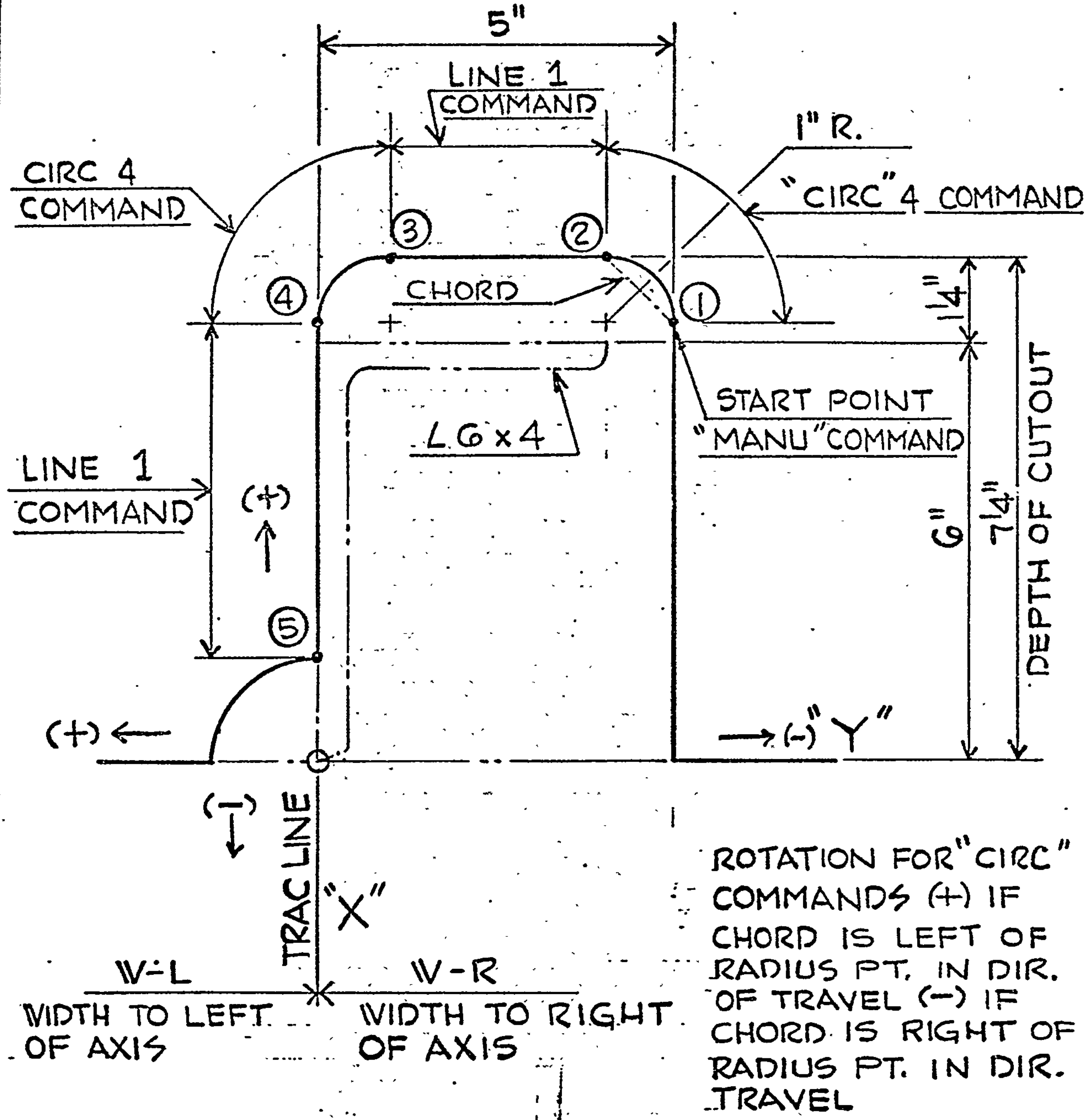
V.E.

SPADES SYSTEM INPUT DATA FORM

PROGRAM CUT OUTS PROGRAMMER T. PROGRAMMER DATE 6-17-78 PAGE 1 OF 1

COMMAND		ALPHABETIC INFORMATION (CODE, 2, 3, 4)	FIELD 1	FIELD 2	FIELD 3		FIELD 4		POINT FIELDS (1, 2, 3)	CARD ID (JOB NO., TAPE NO., SHEET NO.)	LINE NO.
*JØB		LS03HULDDISK	N 8							17000801	[illegible]
INPS			N 8								[illegible]
ØPTN		16THLØAD									[illegible]
RMKS		HULLJ45HOTCHES									1 2
CUTS		NT	N 1 02								1 6
SIZE			1 8	-5	9 4	L	1 8	R			2 0
MANU			7 4	-5							2 4
CIRC	4		9 4	-4	1			+			2 8
LINE	1		9 4	-1							3 2
CIRC	4		7 4	0	1			+			3 6
LINE	1		1 8	0							4 0
INPE										17000899	[illegible]
											4 8
											5 2
											5 6
											6 0
											6 4
											6 8
											7 2
											7 6
											8 0
											8 4
											8 8
											9 2

VI.A.



LEVINGSTON SHIPBUILDING CO.	HULL STRUCTURAL STANDARD TITLE TYPICAL N/C CUTOUT	
	STD. NO.	ALT NO
	DATE SHT. NO.	

VI. B.

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